INSTRUMENT SERVICES

INSTALLATION AND OPERATING INSTRUCTIONS

CONRAC®

TELEVISION MONITOR
MODEL CMC

CONRAC DIVISION Glendora, California

A DIVISION OF GIANNINI CONTROLS CORPORATION

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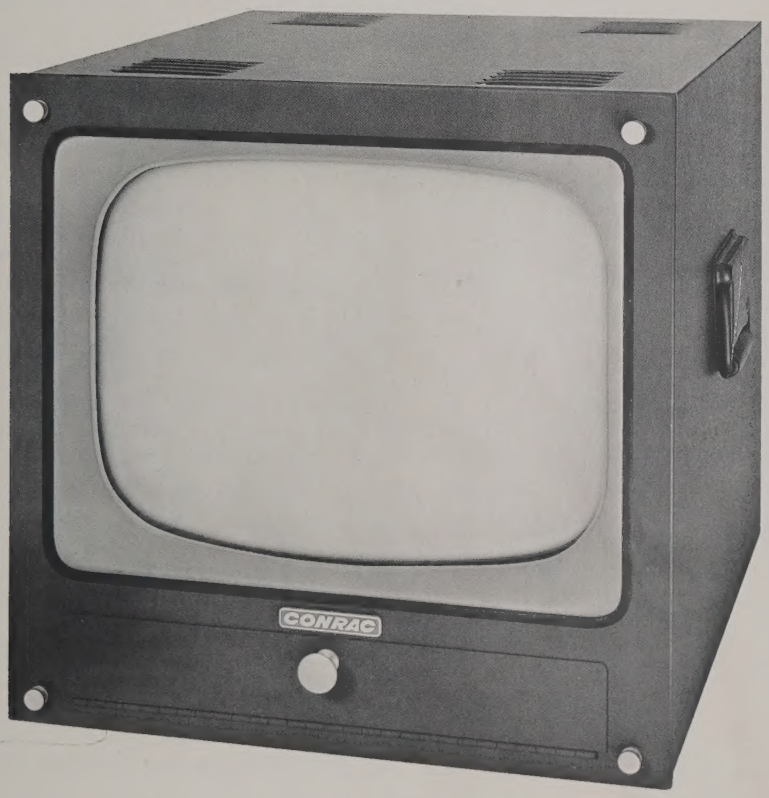

MODEL CMC17/C, FRONT VIEW

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CONRAC CMC MONITOR

The Conrac CMC series monitor, available with 14", 17" or 21" picture tube, is intended primarily as a secondary master monitor. It has fully regulated power supplies, both B+ and anode, and will satisfactorily operate in areas having extremely poor power line regulation.

A video input cathode follower reduces line loading to an absolute minimum. All operating and set-up controls are accessible from the front panel.

TECHNICAL SUMMARY

ELECTRICAL SPECIFICATIONS

Power Input	105-125/210-250 volts, 50/60 cycles, 300 watts, connected for 117 volt operation at the factory, unless otherwise specified. Primary Fuses: 3 Amp., 3 AG Slo-Blo 1½ Amp., 3 AG Slo-Blo Power Connector: Hubbel #7486
Video Signal Required	.2 volt peak (minimum for 50 volts at kinescope cathode, sync negative).
Sync Signal Required	2-8 volts, sync negative.
Video Input Impedance	1. High impedance for bridging. 2. 75-ohm terminating resistance with switch on rear apron.
Video Frequency Response	Flat to 10 mc ± 1 db. 6 db point above 10.5 mc.
Deflection Linearity	1½% of picture height.

MECHANICAL SPECIFICATIONS

MODEL	LENGTH	WIDTH	HEIGHT	SHIPPING WEIGHT
CMC14/C	20-9/16"	17-11/16"	14-5/16"	112 Lbs.
CMC14/N	19-13/16"	16-3/4"	13-3/8"	76 Lbs.
CMC14/R	20-1/2"	19"	14"	95 Lbs.
CMC17/C	20-1/2"	18-1/2"	17-3/4"	122 Lbs.
CMC17/N	20-1/2"	16-5/8"	16-3/8"	84 Lbs.
CMC17/R	20-1/2"	19"	17-1/2"	104 Lbs.
CMC21/C	24-3/4"	24"	22-1/2"	173 Lbs.
CMC21/N	23-3/8"	21"	20-1/4"	97 Lbs.
CMC21/R	24"	24"	22-3/4"	147 Lbs.

FINISH - Deep Umber Gray, Baked Enamel

TUBE COMPLEMENT

V1	6AU6	Cathode Follower
V2	6AU6	1st Video Amplifier
V3	6CB6	2nd Video Amplifier
V4	12BY7	Video Output Amplifier
V5	12BY7	Video Output Amplifier
V301	6080	Low Voltage Regulator
V302	6080	Low Voltage Regulator
V303	6AU6	DC Amplifier
V304	OB2	Voltage Reference Tube
V401A	$\frac{1}{2}$ 12AU7	DC Restorer
V401B	$\frac{1}{2}$ 12AU7	1st Sync Amplifier
V402	6BY6	Sync Stripper
V403A	$\frac{1}{2}$ 6AN8	Sync Cathode Follower
V403B	$\frac{1}{2}$ 6AN8	Horizontal Sync Amplifier
V404	6BY6	Horizontal Sync Gate
V405	6C4	Horizontal Sync Phase Splitter
V406	6AL5	Horizontal Phase Detector
V501	6CG7	Vertical Oscillator
V502	6BL7GT	Vertical Output
V601	6CG7	Horizontal Oscillator
V602	6CB5A	Horizontal Output
V603	6AU4GT	Damper
V604	1B3GT	High Voltage Rectifier
V605	6BK4	High Voltage Regulator

Kinescope: 14" - 14BAP4
17" - 17DWP4
21" - 21EYP4

SILICON DIODES

SR305	1N3195	Low Voltage Rectifier
SR306	1N3195	Low Voltage Rectifier

UNPACKING

Carefully remove all packing material from the equipment received and inspect it for possible damage incurred during shipment. Report any shortage or damage to the carrier. Before applying power to the monitor, make sure the kinescope components are properly positioned. In addition, check to see that all cable connectors and vacuum tubes are secure in their sockets.

INSTALLING THE PICTURE TUBE, 21" UNITS ONLY

The monitor is shipped with all tubes installed, except the kinescope. To install the kinescope, remove the monitor chassis from its housing.

Unpack the kinescope, using extreme care not to scratch the tube or to subject it to more than moderate pressures. Place the tube in position on the chassis, using caution not to damage the yoke windings, as the prongs of the tube are passed through the yoke. The anode connector must be on your left as you face the tube.

Place the tie-down strap in position over the front of the kinescope, passing the ends through the holes in the brackets just outside the hardwood tube support blocks. Place a #10 lockwasher and a #10-32 nut on each end of the strap. Tighten the nuts securely. Plug the anode connector into the receptacle on the side of the kinescope. Place the kinescope socket on the tube.

Plug line cord into a 117 volt, 60 cycle supply, and turn monitor ON. Connect a source of composite video to the INPUT jack, J1 or J2. The line may be terminated by switching S1 to 75 ohms. It should now be possible to see a picture on the screen.

DESCRIPTION

VIDEO SECTION

The composite video signal is fed into the monitor through jacks J1 and J2. It is applied to the grid of V1/6AU6, the input cathode follower. The cathode follower adds negligible capacitive loading across the loop-through input jacks and, in addition, minimizes changes in frequency response at various settings of the contrast control. The cathode follower drives the video amplifier, V2/6AU6, which in turn drives the video amplifier, V3/6CB6. The use of two 12BY7 tubes, V4 and V5, for the final video stage plus degeneration in all high level stages results in exceptional linearity. Switch S401 removes the DC restorer from the circuit when this is desired.

SYNCHRONIZATION

The composite signal at the cathodes of V4 and V5 is used to drive the sync amplifier, V401B/$\frac{1}{2}$ 12AU7, (oscillogram 2, top). This tube is also used when the monitor is operated on external sync. The amplified composite signal (sync positive) drives V402/6BY6 (oscillogram 2, bottom) to grid current while the video information drives the tube beyond cut-off. The output consists of composite horizontal and vertical sync (oscillogram 3).

A cathode follower-limiter, V403A/$\frac{1}{2}$ 6AN8, drives the integrator network and the horizontal sync amplifier (oscillogram 4).

GATE CIRCUIT

It has been noted that: (1) the vertical sync pulses have a time duration longer than the horizontal sync pulses, and (2) the "extra" equalizing pulses create an error voltage in conventional television AFC sync systems. In effect, the horizontal oscillator receives incorrect information during vertical sync time. Under these conditions, the horizontal oscillator cannot always return to the condition of correct timing until some time after the screen is unblanked. The effect is visible as bending at the top of the picture.

These two causes of bending or "sync hook" have been eliminated in this monitor. Composite sync from the cathode follower, V403, is first differentiated by the network, C414 and R431 (oscillogram 4, top). The resulting pulses are then amplified and clipped in V403 and the negative going portion of the differentiated signal is removed by the action of this tube. The output waveform consists of a series of pulses of nearly identical width (oscillogram 4, bottom).

The sync pulses are applied to pin 1 of the 6BY6/V404 and a 15.75 KC keying wave is applied to pin 7 of the same tube (oscillogram 5, top). The action of the tube is such that the unwanted equalizing pulses will be gated out. A switch on the front apron has been incorporated so that the gating may be turned off for non-standard sync.

The output of V404 (oscillogram 5, bottom, and 6, top) consists of a train of uniform negative pulses that are applied to the phase splitter. Horizontal sync pulses from the phase splitter (oscillogram 7, top) and the horizontal sawtooth (oscillogram 7, bottom) are applied to the phase detector, which produces the AFC correction voltage.

HORIZONTAL

The horizontal deflection circuitry is similar to that commonly employed in color television monitors. It consists of a stabilized multivibrator which drives a flyback type deflection and high voltage system to which has been added a 6BK4 shunt regulator, V605. The 18 KV second anode voltage is regulated within plus or minus two percent. Reference voltage for the high voltage regulator is derived from the "B" boost circuit, which varies inversely with the ultor current. The system is protected with a 3/10 amp., 3 AG Slo-Blo fuse, located inside the horizontal deflection compartment.

VERTICAL DEFLECTION

The vertical deflection system consists of a multivibrator and amplifier system employing a type V501/6CG7 oscillator and a V502/6BL7 vertical output tube. Negative feedback is employed to improve linearity.

POWER SUPPLY

Two transformers, T301 and T302, designed to operate at the same flux density, are symmetrically deposed about the kinescope neck and phased in such a manner that their external magnetic fields cancel in the vicinity of the kinescope.

The tube heaters are divided into two groups and fed from a 12.6 volt winding with its center tap grounded to chassis. The tubes in the two heater groups are intermingled on the chassis in such positions as to permit grounding one side of each heater to the chassis without developing excessive 60 cycle chassis currents.

The power supply utilizes silicon rectifiers in a voltage doubler configuration. The output is regulated by two 6080 tubes, V301 and V302.

OPERATION FROM A 234 VOLT SOURCE

If the unit is to be operated from a 210-250 volt source, either 50 or 60 cycles, both power transformers must be reconnected by changing the straps on the tie points associated with the transformer. Remove the straps from points A and B, and C and D, on each strip. Strap points B and C to each of the strips. Change fuse F301 from 3 amperes slo-blo to $1\frac{1}{2}$ amperes slo-blo. Change fuse F302 from $1\frac{1}{2}$ amperes to 3/4 ampere slo-blo.

MAINTENANCE

WARNING: The voltages employed in this equipment are sufficiently high to cause injury. Every reasonable precaution has been observed to safeguard maintenance personnel. Power should be removed completely before changing tubes or making internal repairs. Make certain that the power is off and capacitors are discharged before touching any component. Be very careful of hot tubes.

GENERAL

Conrac monitors are conservatively designed for continuous operation. With a reasonable amount of care, a minimum amount of service will be required to keep the equipment in satisfactory operating condition.

POWER SUPPLY REGULATORS

Before making adjustments in the monitor, it is essential that regulated supply be at 285 volts. Connect a meter of known accuracy to the test point (located on the rear apron). Rotate the potentiometer adjacent to the test point until the meter reads 285 volts.

Connect a high voltage probe to the kinescope ultor button. Set size switch, S601, to "S". Turn the brightness full counterclockwise. Set the high voltage regulator adjustment to 18,000 volts.

HORIZONTAL DRIVE

Connect a source of composite video to the INPUT jack, J1 or J2. Terminate the line by switching S1 to 75 ohms.

Set the horizontal drive control until the characteristic "drive line" appears. Then reverse the direction of rotation until the line just disappears. If "drive line" is not obtained, leave drive control at CW end, or position of best linearity. Set the horizontal hold potentiometer, P602, to the center of its range and temporarily ground pin 6 of V405/6C4. Adjust the ringing coil, L605, until the pattern on the screen is upright and nearly stationary. Remove the temporary ground.

LINEARITY - GENERAL

It is a simple matter to adjust the monitor to produce horizontal and vertical sweep which is linear within 2% of picture height. With careful adjustment, the sweeps may be made linear within 1%. Supply the monitor with a video signal, which in turn will produce a grating bar test pattern on the screen. Allow the monitor to warm up for a period of at least 15 minutes before making adjustments. Set the width coil, L602, to produce the desired width, usually about 2% greater than the screen width.

Place a transparent overlay of the grating bar test pattern in front of the picture tube screen. If such overlay is not available, attach a piece of pressure-sensitive tape, such as Scotch masking tape, to the picture tube face, along the horizontal or vertical axis for the entire diameter of the screen. Rule off equally spaced marks on the tape corresponding to the number of bars in the grating pattern. After the tape is ruled off and in place, adjust the controls on the monitor to make the grating lines on the raster coincide with the marks on the paper tape, as outlined below.

HORIZONTAL LINEARITY

Set the ultor voltage to 18 KV nominal, as outlined under Power Supply Regulators.

Because "width" and "high voltage regulator" adjustments affect each other, repeat the above steps until correct width and high voltage are obtained simultaneously.

Adjust the horizontal linearity coil, L604, for best linearity, particularly observing the center and right side of the screen.

If the linearity coil, L604, is grossly misadjusted, such as might happen if the coil or its associated capacitors have been replaced, remove all fuses, including the 3/10 ampere fuse, located on the rear wall of the high voltage compartment, and connect a 0-500 milliammeter in place of the fuse to measure the horizontal amplifier current. Adjust the linearity coil, L604, for minimum current; turn the linearity adjustment counterclockwise one or two turns to find the position of best linearity. Remove meter and replace fuse.

Adjust the horizontal drive control, P608, observing particularly the extreme right side of the raster. Repeat the above procedure as required to obtain the best linearity, noting especially the right half of the screen.

Compare the left and right sides of the grating pattern, and note whether the left side of the raster is "stretched" or "compressed" with respect to the right side. If the left side is "stretched", i.e., if the distance from the left grating bar to the center grating bar is greater than the distance from the center grating bar to the right grating bar, the high voltage adjustment on the rear apron should be reset so that the anode voltage is somewhat less than 18 KV. Similarly, "left side compression" may be corrected by setting the ultor voltage to a value greater than 18 KV. The unit may be safely operated with anode voltage as great as 20 KV.

VERTICAL LINEARITY

Adjust the height and vertical linearity controls to produce a raster of approximately the correct height with reasonably good linearity. Adjust the vertical feedback control so that the top few scanning lines are spaced similarly to those near the center of the screen.

Using the vertical centering control, align the center grating bar on the raster with the center line on the overlay chart of "linearity tape".

Make slight adjustments of height, vertical feedback, and vertical linearity, as required to match the grating bars to the overlay chart or tape. Since these controls interact, it is necessary to repeat the adjustments several times in sequence to achieve optimum linearity. Note that the height adjustment affects primarily the bottom half of the picture, and that the vertical linearity and vertical feedback controls affect principally the top half of the picture.

VIDEO ALIGNMENT INSTRUCTIONS

Equipment Required:

1. Video sweep generator capable of producing flat sweep to 10 mc.
2. Oscilloscope with suitable low frequency response.
3. Low capacitance detector probe. Recommend Tektronix cathode follower probe #PR500 CF followed by crystal rectifier.

Procedure:

1. Turn on monitor and allow to warm up. Set controls as follows:
   a. Contrast control between 25% and 50% rotation.
   b. DC restorer switch (rear apron) to "ZERO".
   c. Brightness control at minimum (CCW) position.
2. Connect sweep generator to video input jack and adjust to deliver .1 to .5 volts peak.
3. Connect scope probe to grid of V3/6CB6. If Tektronix PR500 CF probe is used, remove attenuator attachment. Adjust L1 and L2 for flattest frequency response.
4. Move scope probe to kinescope cathode terminal (conveniently available on pins 1 and 2 of V401A) and adjust L3 and L4 for flattest frequency response.

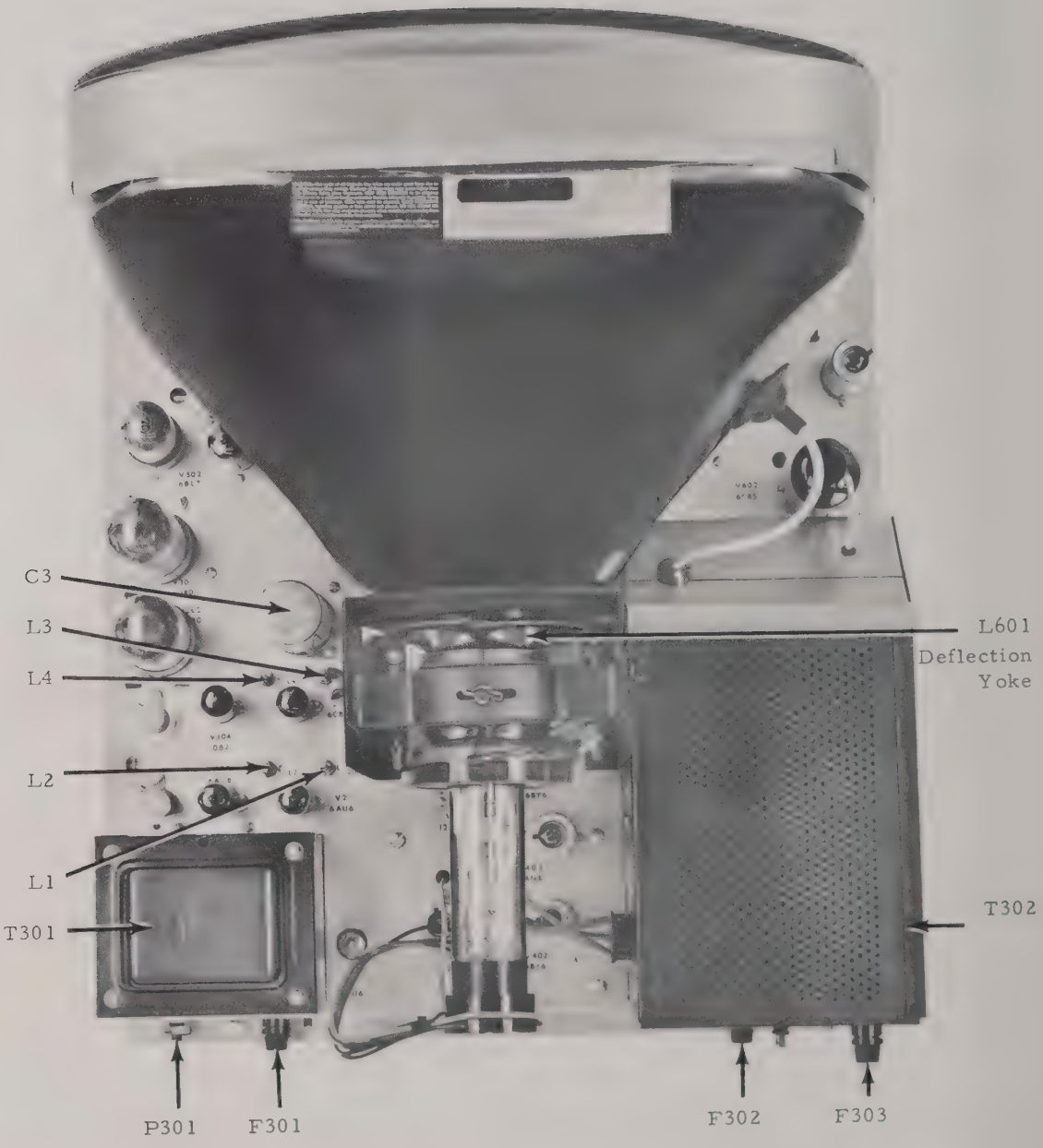
NOTE: If the Tektronix probe mentioned above is used, add the probe attenuator attachment for this test.

CAUTION: Reduce signal generator output if necessary to avoid overloading of amplifiers or probe.

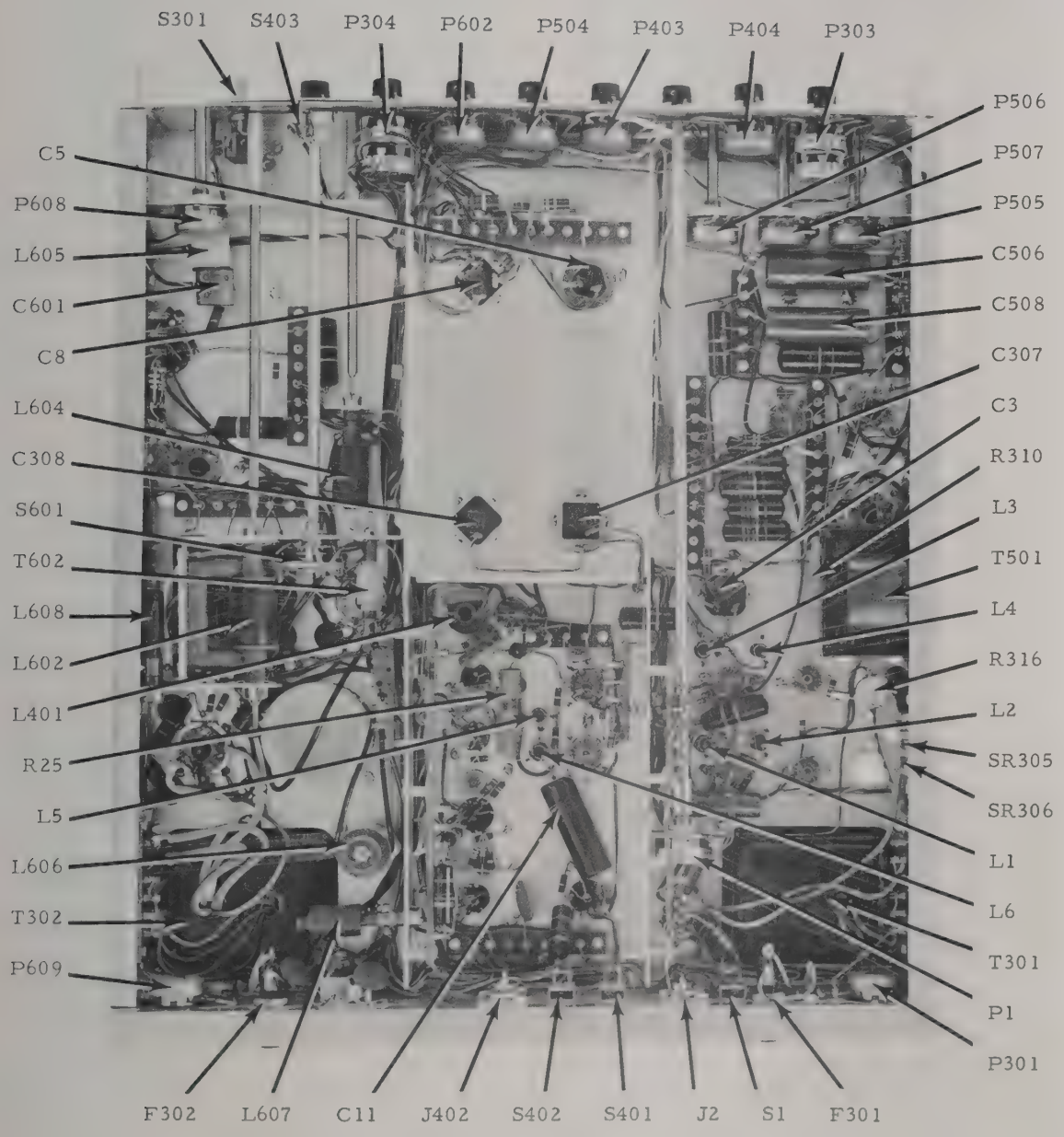
The over-all response should now look like oscillogram 1. With the probe still connected to the final output, it is permissible to touch up slightly all the peaking coils to produce flattest over-all response.

HORIZONTAL GATE COIL ADJUSTMENT

If the equalizing pulses do not appear to be gated out properly, check the adjustment of L401. Connect a low capacity probe across L401 and carefully adjust this coil for maximum signal amplitude.

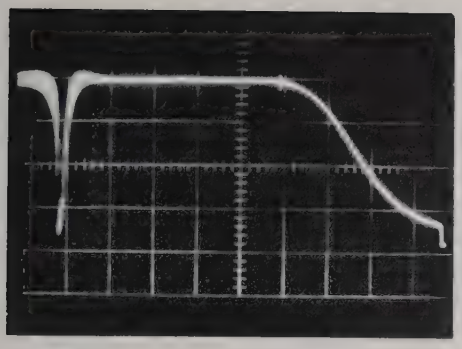


MODEL CMC17, TOP VIEW

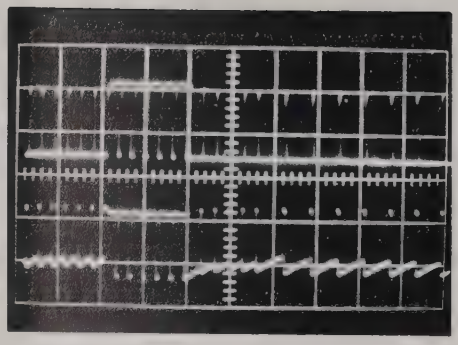


MODEL CMC17, BOTTOM VIEW

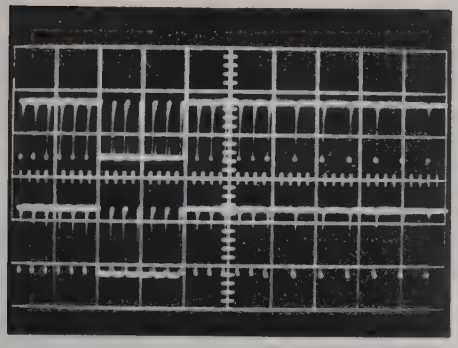
BLOCK DIAGRAM
CMC MONITOR



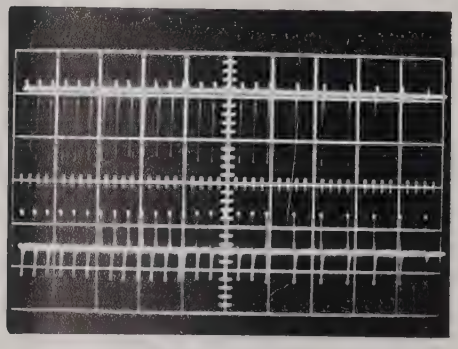
1. Video Sweep Response
   9 mc. marker



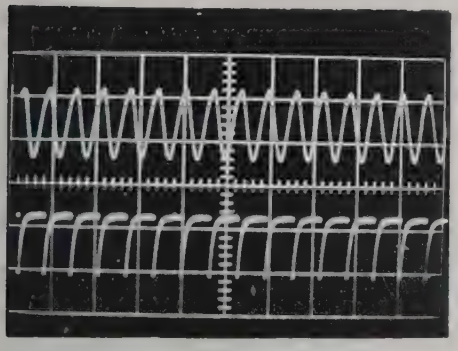
2. Top- Pin 6, V401 2v/cm.
   Bottom-Pin 7, V402 2v/cm



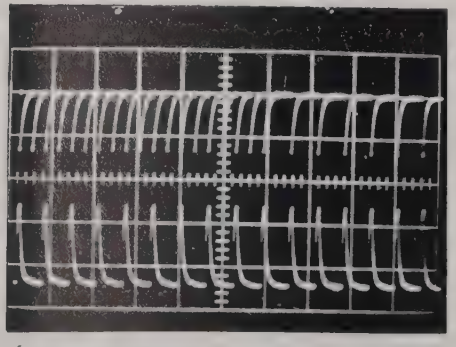
3. Top-Pin 5, V402 10v/cm
   Bottom-Pin 3, V403 5 v/cm



4. Top-Pin 8, V403 2v/cm
   Bottom-Pin 6, V403 50v/cm

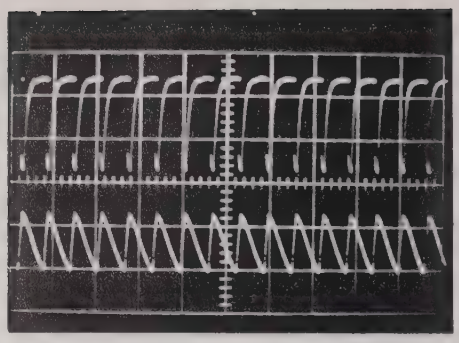


5. Top-Pin 7, V404 50v/cm
   Bottom-Pin 5, V404 100v/cm
   (sw. on)

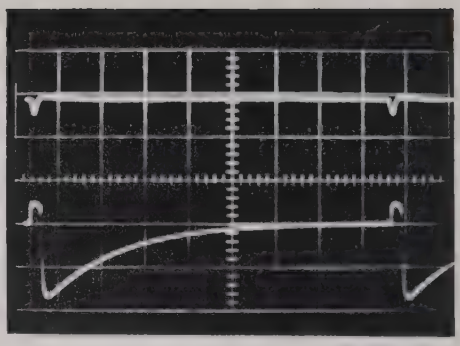


6. Top-Pin 5, V404 100v/cm
   (sw. off)
   Bottom-Pin 1, V405 20v/cm

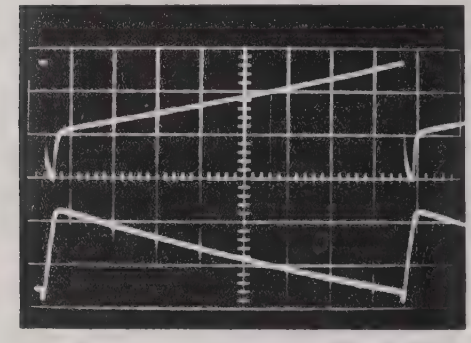
OSCILLOGRAMS



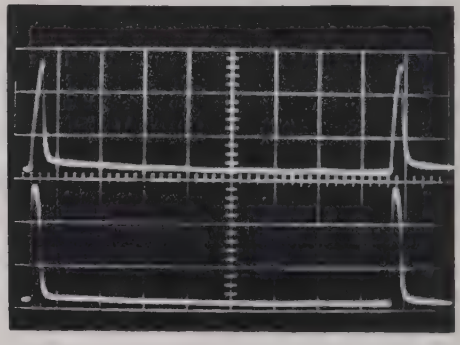
7. Pin 7, V405 20v/cm
Pin 1 & 2, V406 5v/cm



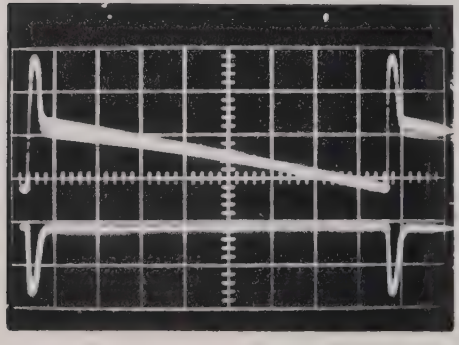
8. Pin 2, V501(Trigger) .5v/cm
Pin 7, V501 25v/cm



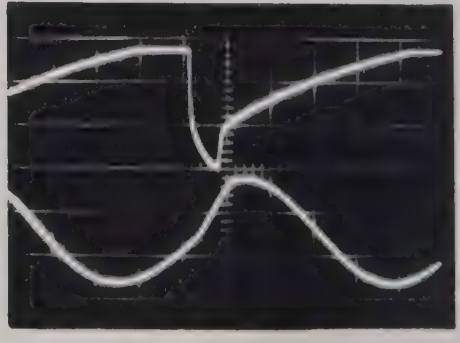
9. Pin 6, V501 10v/cm
Junction C503, C504 20v/cm



10. Pin 1, V501 25v/cm
Pin 8, V501 2v/cm

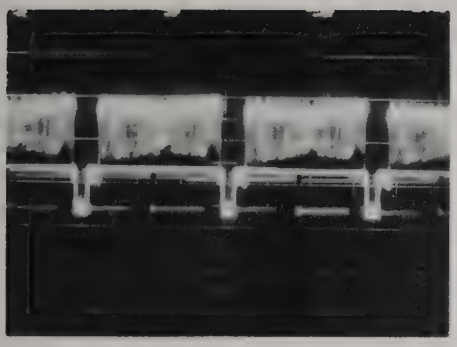


11. Pin 2, V502 100v/cm
Kinescope grid 10v/cm

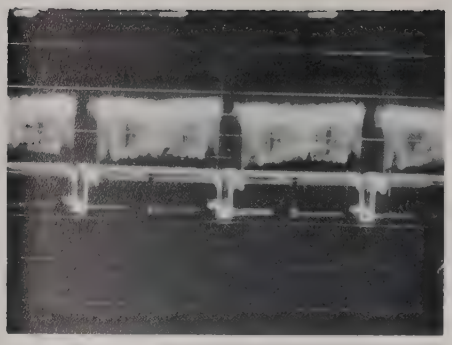


12. Pin 6, V601 50v/cm
Junction L605, R602 10v/cm

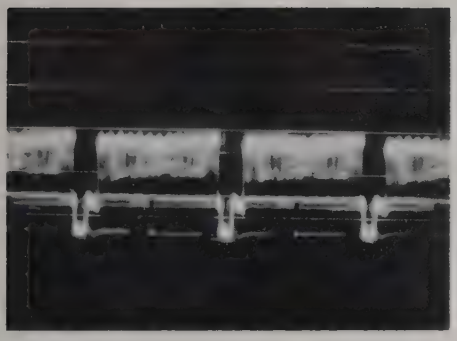
OSCILLOGRAMS



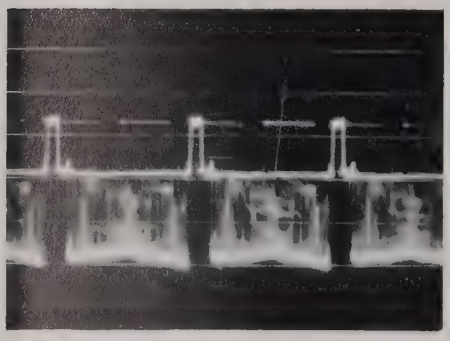
13. Pin 1, V1 .5v/cm
Input



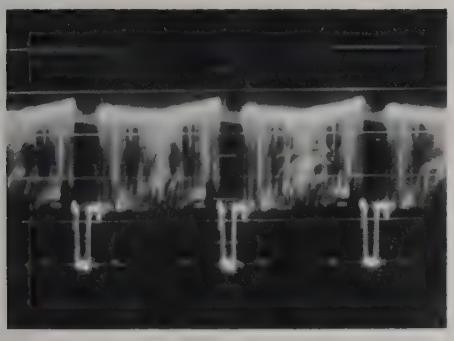
14. Pin 1, V2 .5v/cm
Contrast max. CW position



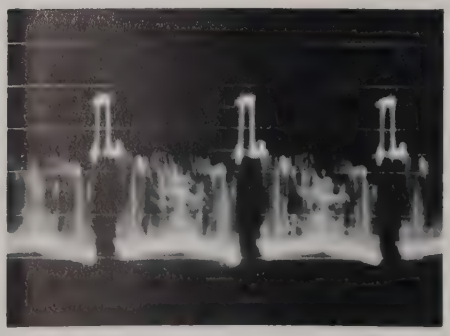
15. Pin 1, V2 .1v/cm
Contrast set for 40 volts p-p at kinescope cathode



16. Pin 1, V3 .3v/cm
Contrast set for 40 volts p-p at kinescope cathode



17. Pin 2, V4 and V5 1v/cm
Contrast set for 40 volts p-p at kinescope cathode



18. Pin 11, V6 10v/cm
Kinescope cathode

OSCILLOGRAMS

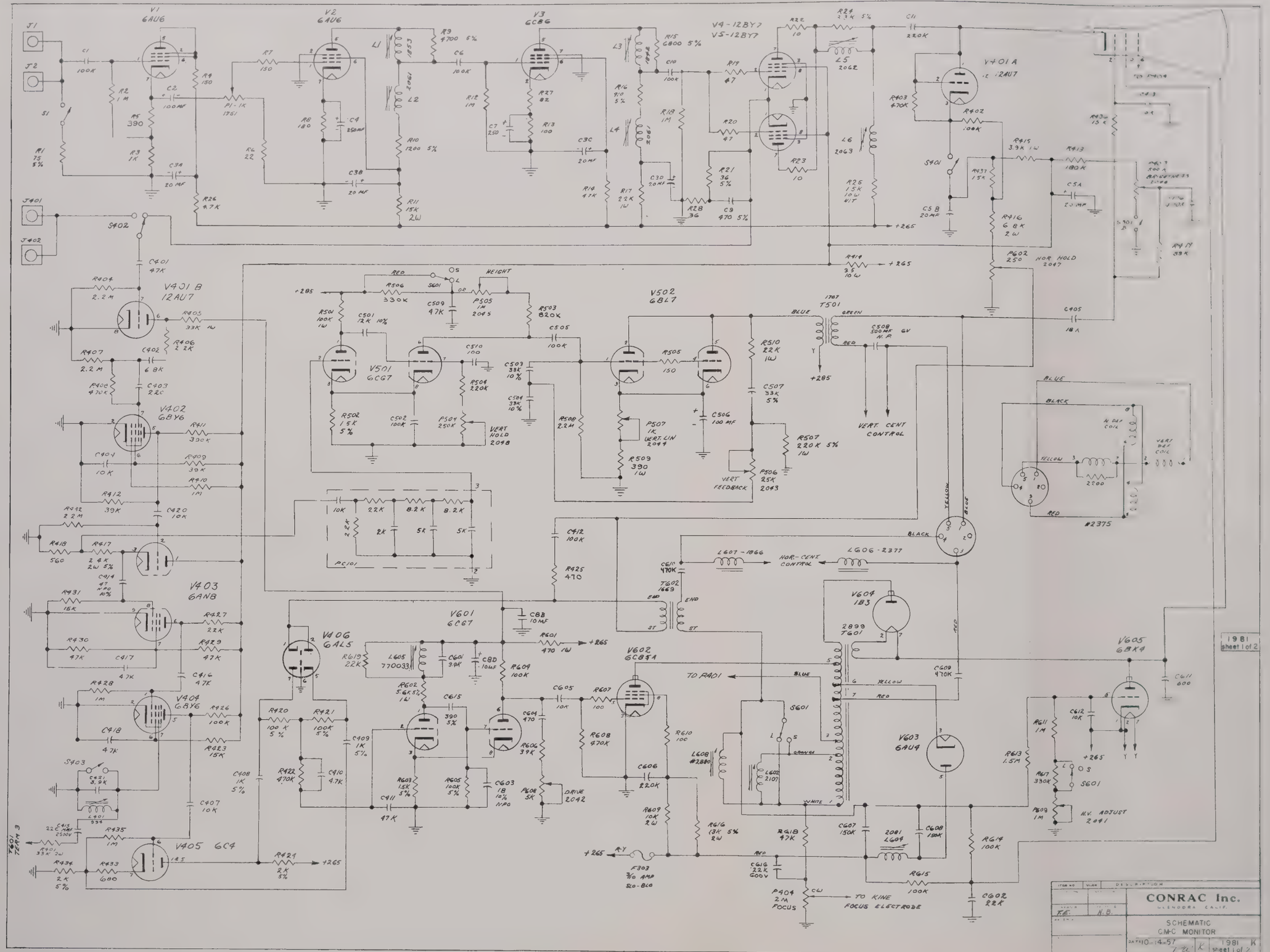
CMC MONITOR NOMINAL VOLTAGE CHART

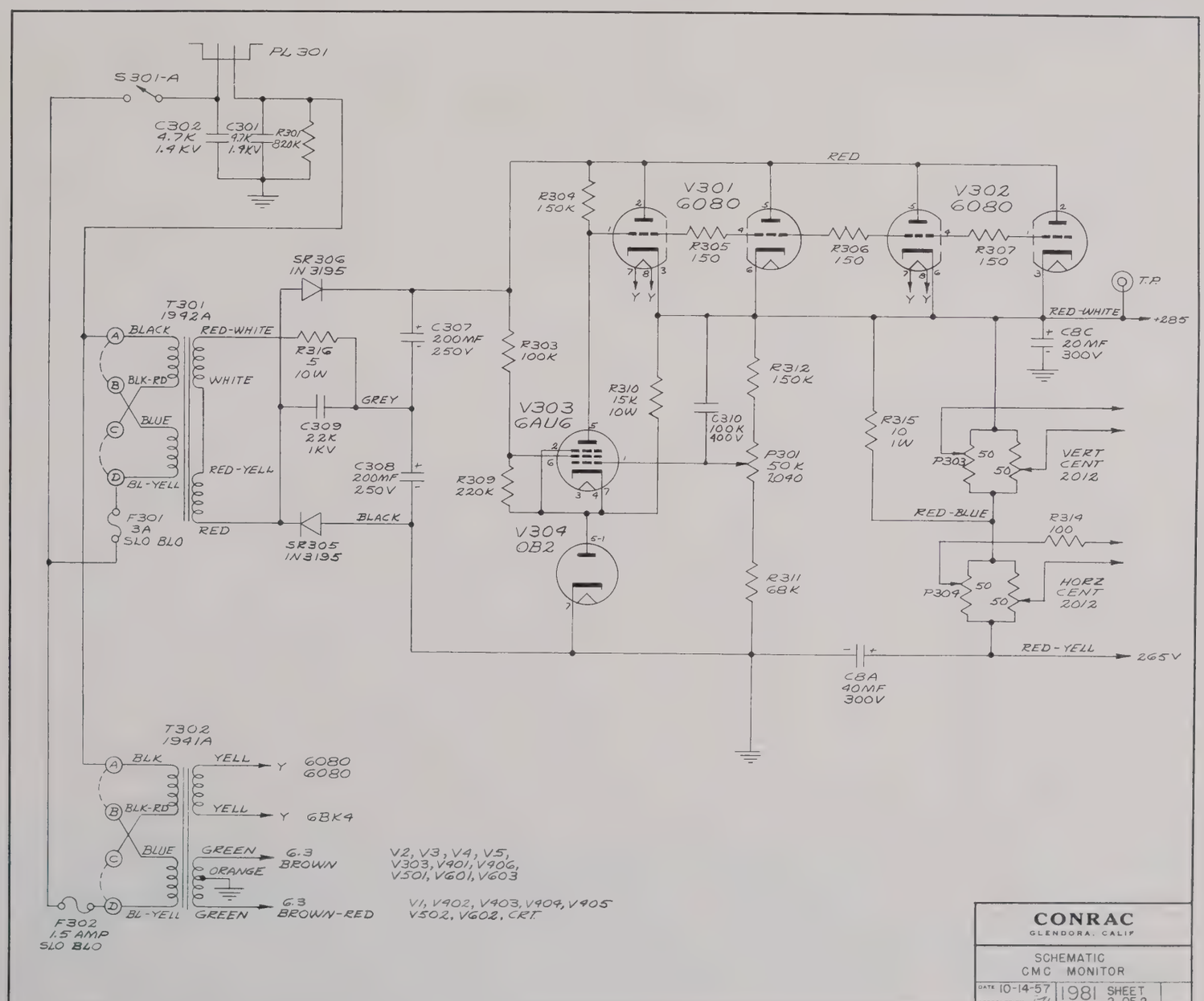
Line voltage 117 volts (B supply regulated at 285); all controls normal and size switch in position "S". Voltages measured from tube socket to chassis with VTVM.

PIN	1	2	3	4	5	6	7	8	9
V1/6AU6	8.6	220	F	G	220	220	13.8		
V2/6AU6	0	G	F	G	137	145	1.5		
V3/6CB6	0	1.9	F	G	245	145	G		
V4/12BY7	2.3	.2	G	F	F	G	185	145	
V5/12BY7	2.3	.2	G	F	F	G	185	145	
V301/6080	260	380	285	260	380	285	265	265	
V302/6080	260	380	285	260	380	285	265	265	
V303/6AU6	105	110V	F	G	260	270	110		
V304/OB2	NC	G	NC	G	105	NC	G		
V401/12AU7	59	59	82	F	F	75	-.7	G	G
V402/6BY6	-.15	G	G	F	12.6	16.5	-11.6		
V403/6AN8	150	0	7.5	G	F	39	42	-.5	G
V404/6BY6	-43	G	G	F	129	127	12.3		
V405/6C4	235	NC	G	F	235	23	38		
V406/6AL5	1.5	1.5	G	F	32	G	-20		
V501/6CG7	96	0	3.0	G	F	36	-12.6	3.0	G
V502/6BL7	0	280	15	0	280	15	G	F	
V601/6CG7	230	1.8	10.3	F	G	140	-6.7	10.3	G
V602/6CB5A	NC	G	G	NC	-36.5	NC	F	155	
V603/6AU4	NC	NC	*	NC	265	NC	F	G	
V604/1B3	- MEASURE WITH HIGH VOLTAGE METER - 18KV								
V605/6BK4	265	265	NC	NC	255	NC	265	NC	

* Pulses present - Do not measure.

Kinescope Socket:
Pin 1 - G
Pin 2 - 0-100 V
Pin 6 - 0-500 V
Pin 10 - 450 V
Pin 11 - 100 V
Pin 12 - F


V1 6AU6
V2 6AU6
V3 6CB6
V4-12BY7
V5-12BY7
V401A 1/2 12AU7
V401B 1/2 12AU7
V402 6BY6
V403 6AN8
V404 6BY6
V405 6C4
V501 6CG7
V502 6BL7
V601 6CG7
V602 6CB5A
V603 6AU4
V604 1B3
V605 6BX4
V606 6AL5
J1
J2
J401
J402
S1
S401
S402
S403
S601
TO RADI
TO KINE FOCUS ELECTRODE
VERT HOLD 2098
VERT. LIN 2044
VERT FEEDBACK
VERT. CENT CONTROL
HOR. CENT CONTROL
HOR HOLD 2047
HEIGHT
DRIVE 2042
H.V. ADJUST 2041
F303 3/10 AMP 20-BLO
#2375
CONRAC Inc.
GLENDORA CALIF.
SCHEMATIC
CMC MONITOR
DATE 10-14-57
1981 K
sheet 1 of 2


PL 301
S 301-A
C302 4.7K 1.4 KV
C301 .47K 1.9KV
R301 820K
RED
R304 150K
V301 6080
R305 150
R306 150
V302 6080
R307 150
T.P.
RED-WHITE
+285
C8C 20MF 300V
SR306 IN3195
T301 1942A
BLACK
RED-WHITE
R316 5 10W
WHITE
BLK-RD
BLUE
GREY
C309 22K 1KV
RED-YELL
BL-YELL
F301 3A SLO BLO
RED
BLACK
SR305 IN3195
C307 200MF 250V
C308 200MF 250V
R303 100K
R309 220K
V303 6AU6
R310 15K 10W
C310 100K 400V
R312 150K
P301 50K LOG
V304 0B2
R311 68K
R315 10 1W
P303 50 50
VERT CENT 2012
RED-BLUE
R314 100
P309 50 50
HORZ CENT 2012
RED-YELL
265V
C8A 40MF 300V
T302 1941A
BLK
YELL
Y 6080 6080
BLK-RD
YELL
Y 6BK4
BLUE
GREEN
6.3 BROWN
ORANGE
BL-YELL
GREEN
6.3 BROWN-RED
F302 1.5 AMP SLO BLO
V2, V3, V4, V5, V303, V401, V906, V501, V601, V603
V1, V902, V903, V904, V905 V502, V602, CRT
CONRAC
GLENDORA, CALIF
SCHEMATIC
CMC MONITOR
DATE 10-14-57
APPROVED BY
1981
SHEET 2 OF 2

SYMBOL	DESCRIPTION	PART NO.	MFR.*
	CAPACITORS		
C1	Paper Tub., 100,000 mmf, 20%, 400 V	67P10404	SP
C2	Electrolytic, 100 mfd, 15 V	BBR-100-15T	CD
C3	Electrolytic, 20-20-20-20 mfd, 450 V	UPT-222245	CD
C4	Electrolytic, 250 mfd, 6 V	BBR-250-6T	CD
C5	Electrolytic, 20-20 mfd, 250 V	BO210	CD
C6	Paper Tub., 100,000 mmf, 20%, 400 V	67P10404	SP
C7	Electrolytic, 250 mfd, 6 V	BBR-250-6T	CD
C8	Electrolytic, 40-20-10-10 mfd, 300 V	DOO16	CD
C9	Mica, 470 mmf, 5%, 500 V	CM20B471J	ELM
C10	Paper Tub., 100,000 mmf, 20%, 400 V	67P10404	SP
C11	Paper Tub., 220,000 mmf, 20%, 600 V	160P22406	SP
C301	Cer. Disc, 4700 mmf, 20%, 1400 V		DI
C302	Cer. Disc, 4700 mmf, 20%, 1400 V		DI
C307	Electrolytic, 200 mfd, 250 V	XA0318	CD
C308	Electrolytic, 200 mfd, 250 V	XA0318	CD
C309	Paper Tub., 22,000 mmf, 20%, 1000 V	73P223010	SP
C310	Paper Tub., 100,000 mmf, 20%, 400 V	67P10404	SP
C401	Paper Tub., 47,000 mmf, 20%, 400 V	67P47304	SP
C402	Paper Tub., 6800 mmf, 20%, 600 V	73P68206	SP
C403	Mica, 220 mmf, 20%, 500 V	CM20B221M	ELM
C404	Cer. Disc, 10,000 mmf, 500 V		DI
C405	Paper Tub., 18,000 mmf, 10%, 600 V	73P18396	SP
C406	Paper Tub., 470,000 mmf, 20%, 200 V	67P47402	SP
C407	Cer. Disc, 10,000 mmf, 500 V		DI
C408	Mica, 1000 mmf, 5%, 500 V	CM20B102J	ELM
C409	Mica, 1000 mmf, 5%, 500 V	CM20B102J	ELM
C410	Cer. Disc, 4700 mmf, 20%, 500 V		DI
C411	Paper Tub., 47,000 mmf, 20%, 600 V	73P47306	SP
C412	Paper Tub., 100,000 mmf, 20%, 400 V	67P10404	SP
C413	Cer. Disc, 10,000 mmf, 1600 V	DD16-103	CRL
C414	Cer. Disc, 47 mmf, 10%, 500 V, NPO		DI
C415	Mica, 220 mmf, 20%, 2500 V	VCM20B221M	ELM
C416	Cer. Disc, 4700 mmf, 20%, 500 V		DI
C417	Cer. Disc, 4700 mmf, 20%, 500 V		DI
C418	Cer. Disc, 4700 mmf, 20%, 500 V		DI
C420	Cer. Disc, 10,000 mmf, 500 V		DI
C421	Mica, 3900 mmf, 10%, 500 V	CM20C392K	ELM
C501	Paper Tub., 12,000 mmf, 10%, 600 V	73P12396	SP
C502	Paper Tub., 100,000 mmf, 20%, 400 V	67P10404	SP
C503	Paper Tub., 33,000 mmf, 10%, 600 V	73P33396	SP
C504	Paper Tub., 33,000 mmf, 10%, 600 V	73P33396	SP
C505	Paper Tub., 100,000 mmf, 20%, 600 V	73P10406	SP
C506	Electrolytic, 100 mfd, 50 V	BR-100-50	CD
C507	Paper Tub., 33,000 mmf, 10%, 600 V	73P33396	SP
C508	Electrolytic, 500 mfd, 6 V, Non-Polarized	BRH-10040-1T	CD
C509	Cer. Disc, 4700 mmf, 20%, 500 V		DI
C510	Mica, 100 mmf, 20%, 500 V	CM20B101M	ELM
C601	Mica, 3900 mmf, 10%, 500 V	CM20C392K	ELM
C602	Paper Tub., 22,000 mmf, 20%, 600 V	73P22306	SP

*See Manufacturers List, Page 28.

SYMBOL	DESCRIPTION	PART NO.	MFR.*
	CAPACITORS (Continued)		
C603	Cer. Disc, 18 mmf, 10%, 500 V, NPO		DI
C604	Mica, 470 mmf, 5%, 500 V	CM20B471J	ELM
C605	Paper Tub., 10,000 mmf, 20%, 600 V	73P10306	SP
C606	Paper Tub., 220,000 mmf, 20%, 600 V	160P22406	SP
C607	Paper Tub., 150,000 mmf, 20%, 600 V	160P15406	SP
C608	Paper Tub., 150,000 mmf, 20%, 600 V	160P15406	SP
C609	Paper Tub., 470,000 mmf, 20%, 600 V	PM6P47	SP
C610	Paper Tub., 470,000 mmf, 20%, 600 V	PM6P47	SP
C611	Cer. High Voltage, 500 mmf, 30,000 V	DA202-TU3	CRL
C612	Paper Tub., 10,000 mmf, 20%, 600 V	73P10306	SP
C615	Mica, 390 mmf, 5%, 500 V	CM20B391J	ELM
C616	Paper Tub., 22,000 mmf, 20%, 600 V	73P22306	SP
	COILS		
L1	Peaking	1853	CONRAC
L2	Peaking	2061	CONRAC
L3	Peaking	1842	CONRAC
L4	Peaking	2061	CONRAC
L5	Peaking	2062	CONRAC
L6	Peaking	2063	CONRAC
L401	15.75 KC Gating	781001	CONRAC
L601	Deflection Yoke (CMC14 only)		
	#2375E Yoke with $11\frac{1}{2}$" Leads and Plug	2996	CONRAC
L601	Deflection Yoke (CMC17 and CMC21)		
	#2375E Yoke with $9\frac{1}{2}$" Leads and Plug	2764	CONRAC
L602	Width Coil Assembly (Complete)	2107	CONRAC
L604	Horizontal Linearity	2081	CONRAC
L605	Ringing	770033	CONRAC
L606	Horizontal Isolation	2377	CONRAC
L607	Horizontal Isolation	1866	CONRAC
L608	Energy Storage	2880	CONRAC
	POTENTIOMETERS		
P1	Composition, 1000 ohms, 2 w (Contrast)	1751	CONRAC
P301	Composition, 50,000 ohms, 2 w (L.V. Adjust.)	2040	CONRAC
P303	Composition, 50 ohms, 2 w (Vertical Cent.)	2012	CONRAC
P304	Composition, 50 ohms, 2 w (Horizontal Cent.)	2012	CONRAC
P403	Composition, 500,000 ohms, 2 w (Brightness)	2046	CONRAC
P404	Composition, 2 megohms, 2 w (Focus)	1564	CONRAC
P504	Composition, 250,000 ohms, 2 w (Vertical Hold)	2048	CONRAC
P505	Composition, 1 megohm, 2 w (Height)	2045	CONRAC
P506	Composition, 25,000 ohms, 2 w (Vertical Feedback)	2043	CONRAC
P507	Composition, 1000 ohms, 2 w (Vertical Linearity)	2044	CONRAC
P602	Composition, 250 ohms, 2 w (Horizontal Hold)	2047	CONRAC
P608	Composition, 5000 ohms, 2 w (Drive)	2042	CONRAC
P609	Composition, 1 megohm, 2 w (H.V. Adjust.)	2041	CONRAC

*See Manufacturers List, Page 28.

SYMBOL	DESCRIPTION	PART NO.	MFR.*
	RESISTORS		
R1	Composition, 75 ohms, 5%, 1 w		AB
R2	Composition, 1 megohm, 10%, ½ w		AB
R3	Composition, 1000 ohms, 10%, ½ w		AB
R4	Composition, 150 ohms, 10%, ½ w		AB
R5	Composition, 390 ohms, 10%, ½ w		AB
R6	Composition, 22 ohms, 10%, ½ w		AB
R7	Composition, 150 ohms, 10%, ½ w		AB
R8	Composition, 180 ohms, 10%, ½ w		AB
R9	Composition, 4700 ohms, 5%, ½ w		AB
R10	Composition, 1200 ohms, 5%, ½ w		AB
R11	Composition, 15,000 ohms, 10%, 2 w		AB
R12	Composition, 1 megohm, 10%, ½ w		AB
R13	Composition, 100 ohms, 10%, ½ w		AB
R14	Composition, 47,000 ohms, 10%, ½ w		AB
R15	Composition, 6800 ohms, 5%, ½ w		AB
R16	Composition, 910 ohms, 5%, ½ w		AB
R17	Composition, 2200 ohms, 10%, 1 w		AB
R18	Composition, 1 megohm, 10%, ½ w		AB
R19	Composition, 47 ohms, 5%, ½ w		AB
R20	Composition, 47 ohms, 5%, ½ w		AB
R21	Composition, 36 ohms, 5%, ½ w		AB
R22	Composition, 10 ohms, 10%, ½ w		AB
R23	Composition, 10 ohms, 10%, ½ w		AB
R24	Composition, 3300 ohms, 5%, ½ w		AB
R25	Wire Wound, 1500 ohms, 5%, 10 w, Non-Inductive	Koolohm (NIT)	SP
R26	Composition, 4700 ohms, 10%, ½ w		AB
R27	Composition, 82 ohms, 10%, ½ w		AB
R28	Composition, 36 ohms, 5%, ½ w		AB
R301	Composition, 820,000 ohms, 10%, ½ w		AB
R303	Composition, 100,000 ohms, 10%, ½ w		AB
R304	Composition, 150,000 ohms, 10%, ½ w		AB
R305	Composition, 150 ohms, 10%, ½ w		AB
R306	Composition, 150 ohms, 10%, ½ w		AB
R307	Composition, 150 ohms, 10%, ½ w		AB
R309	Composition, 220,000 ohms, 10%, ½ w		AB
R310	Wire Wound, 15,000 ohms, 10%, 10 w	PW10	IRC
R311	Composition, 68,000 ohms, 10%, ½ w		AB
R312	Composition, 150,000 ohms, 10%, ½ w		AB
R314	Composition, 100 ohms, 10%, ½ w		AB
R315	Composition, 10 ohms, 10%, 1 w		AB
R316	Wire Wound, 5 ohms, 10%, 10 w	A6KS	CL
R401	Composition, 33,000 ohms, 10%, 2 w		AB
R402	Composition, 100,000 ohms, 10%, ½ w		AB
R403	Composition, 470,000 ohms, 10%, ½ w		AB
R404	Composition, 2.2 megohms, 10%, ½ w		AB
R405	Composition, 33,000 ohms, 10%, 1 w		AB
R406	Composition, 2200 ohms, 10%, ½ w		AB
R407	Composition, 2.2 megohms, 10%, ½ w		AB

*See Manufacturers List, Page 28.

SYMBOL	DESCRIPTION	PART NO.	MFR.*
	RESISTORS (Continued)		
R408	Composition, 470,000 ohms, 10%, ½ w		AB
R409	Composition, 39,000 ohms, 10%, ½ w		AB
R410	Composition, 1 megohm, 10%, ½ w		AB
R411	Composition, 390,000 ohms, 10%, ½ w		AB
R412	Composition, 39,000 ohms, 10%, ½ w		AB
R413	Composition, 180,000 ohms, 10%, ½ w		AB
R414	Wire Wound, 3500 ohms, 10%, 10 w	PW10	IRC
R415	Composition, 3900 ohms, 10%, 1 w		AB
R416	Composition, 6800 ohms, 10%, 2 w		AB
R417	Composition, 2400 ohms, 5%, 2 w		AB
R418	Composition, 560 ohms, 10%, ½ w		AB
R419	Composition, 33,000 ohms, 10%, ½ w		AB
R420	Composition, 100,000 ohms, 5%, ½ w		AB
R421	Composition, 100,000 ohms, 5%, ½ w		AB
R422	Composition, 470,000 ohms, 10%, ½ w		AB
R423	Composition, 15,000 ohms, 10%, ½ w		AB
R424	Composition, 2000 ohms, 5%, ½ w		AB
R425	Composition, 470 ohms, 10%, ½ w		AB
R426	Composition, 100,000 ohms, 10%, ½ w		AB
R427	Composition, 22,000 ohms, 10%, ½ w		AB
R428	Composition, 1 megohm, 10%, ½ w		AB
R429	Composition, 47,000 ohms, 10%, ½ w		AB
R430	Composition, 47,000 ohms, 10%, ½ w		AB
R431	Composition, 15,000 ohms, 10%, ½ w		AB
R432	Composition, 2.2 megohms, 10%, ½ w		AB
R433	Composition, 680 ohms, 10%, ½ w		AB
R434	Composition, 2000 ohms, 5%, ½ w		AB
R435	Composition, 1 megohm, 10%, ½ w		AB
R436	Composition, 15,000 ohms, 10%, ½ w		AB
R437	Composition, 1500 ohms, 5%, ½ w		AB
R501	Composition, 100,000 ohms, 10%, 1 w		AB
R502	Composition, 1500 ohms, 5%, ½ w		AB
R503	Composition, 820,000 ohms, 10%, ½ w		AB
R504	Composition, 220,000 ohms, 10%, ½ w		AB
R505	Composition, 150 ohms, 10%, ½ w		AB
R506	Composition, 330,000 ohms, 10%, ½ w		AB
R507	Composition, 220,000 ohms, 5%, 1 w		AB
R508	Composition, 2.2 megohm, 10%, ½ w		AB
R509	Composition, 390 ohms, 10%, 1 w		AB
R510	Composition, 22,000 ohms, 10%, 1 w		AB
R601	Composition, 470 ohms, 10%, 1 w		AB
R602	Composition, 5600 ohms, 5%, 1 w		AB
R603	Composition, 1500 ohms, 5%, ½ w		AB
R604	Composition, 100,000 ohms, 10%, ½ w		AB
R605	Composition, 100,000 ohms, 5%, ½ w		AB
R606	Composition, 3900 ohms, 10%, ½ w		AB
R607	Composition, 100 ohms, 10%, ½ w		AB
R608	Composition, 470,000 ohms, 10%, ½ w		AB

*See Manufacturers List, Page 28.

SYMBOL	DESCRIPTION	PART NO.	MFR.*
	RESISTORS (Continued)		
R609	Composition, 10,000 ohms, 10%, 2 w		AB
R610	Composition, 100 ohms, 10%, $\frac{1}{2}$ w		AB
R611	Composition, 1 megohm, 10%, $\frac{1}{2}$ w		AB
R613	Composition, 1.5 megohms, 10%, $\frac{1}{2}$ w		AB
R614	Composition, 100,000 ohms, 10%, $\frac{1}{2}$ w		AB
R615	Composition, 100,000 ohms, 10%, $\frac{1}{2}$ w		AB
R616	Composition, 13,000 ohms, 5%, 2 w		AB
R617	Composition, 330,000 ohms, 10%, $\frac{1}{2}$ w		AB
R618	Composition, 47,000 ohms, 10%, $\frac{1}{2}$ w		AB
R619	Composition, 22,000 ohms, 10%, $\frac{1}{2}$ w		AB
	SILICON DIODES		
SR305	Low Voltage Rectifier	1N3195	RCA
SR306	Low Voltage Rectifier	1N3195	RCA
	TRANSFORMERS		
T301	Plate	1942A	CONRAC
T302	Filament	1941A	CONRAC
T501	Vertical Output	1707	CONRAC
T601	Horizontal Output	2899	CONRAC
T602	Horizontal AFC	1669	CONRAC
	MISCELLANEOUS		
F301	Fuse: 3 Ampere Slo-Blo	313003	LF
F302	Fuse: 1.5 Ampere Slo-Blo	31301.5	LF
F303	Fuse: 3/10 Ampere Slo-Blo	313.300	LF
J1	Receptacle: Female (SO239)	888002	CONRAC
J2	Receptacle: Female (SO239)	888002	CONRAC
J401	Receptacle: Female (SO239)	888002	CONRAC
J402	Receptacle: Female (SO239)	888002	CONRAC
PL301	Receptacle: Flush Base	7486	HUB
S1	D.P.D.T. Slide Switch	4603	MU
S301	D.P.S.T. Toggle Switch	3009	CONRAC
S401	D.P.D.T. Slide Switch	4603	MU
S402	D.P.D.T. Slide Switch	4603	MU
S403	D.P.D.T. Slide Switch	4603	MU
S601	Switch: Size	2945	CONRAC
	Cap: Plate (611)	712002	CONRAC
	Cup: Socket, H.V. Barrier	269001	CONRAC
	Feet (CMC14/C)	2120	CONRAC
	Feet (CMC17/C)	2808	CONRAC
	Feet (CMC21/C)	314002	CONRAC
	Fuse Extractor Post	342012	LF
	Fuse Extractor Post	342001	LF
	Knobs (Black)	1400	HD
	Line Cord	3028	CONRAC

*See Manufacturers List, Page 28.

REPLACEABLE PARTS - MODEL CMC

SYMBOL	DESCRIPTION	PART NO.	MFR.*
	MISCELLANEOUS (Continued)		
	Mask (CMC14/C)	1738	CONRAC
	Mask (CMC17/C)	1599	CONRAC
	Mask (CMC21/C)	1601	CONRAC
	Plug: Connector	7484	HUB
	Safety Glass (CMC14/C)	1752	CONRAC
	Safety Glass (CMC17/C)	1598	CONRAC
	Safety Glass (CMC21/C)	1600	CONRAC
	Socket: 7 Pin	SM154-125L	ME
	Socket: 7 Pin	13724	CI
	Socket: 9 Pin	SM162-125F	ME
	Socket: 9 Pin	12825	CI
	Socket: High Voltage (1B3)	938001	CONRAC
	Socket: Kinescope	3030	CONRAC
	Socket: Octal	51B16309	CI
	Socket: Octal	940001	CONRAC
	Socket: Yoke	77MIP5	AMP
	Vertical Integrator	PC101	CRL

*See Manufacturers List Below.

MANUFACTURERS OF REPLACEABLE PARTS

CODE	MANUFACTURER	LOCATION
AB	Allen-Bradley Co.	Milwaukee 4, Wisconsin
AMP	Amphenol-Borg Electronics Corp.	Chicago, Illinois
CD	Cornell-Dubilier Electric Co.	South Plainfield, New Jersey
CI	Cinch Manufacturing Co.	Chicago, Illinois
CL	Clarostat Manufacturing Co.	Dover, New Hampshire
CONRAC	Conrac Division	Glendora, California
CRL	Centralab	Milwaukee 1, Wisconsin
DI	Dilectron Corp.	Monrovia, California
ELM	Elmenco Products Co.	New York, New York
HD	Harry Davies Molding	Chicago 10, Illinois
HUB	Harvey Hubbell, Inc.	Bridgeport 5, Connecticut
IRC	International Resistance Co.	Philadelphia 8, Pennsylvania
LF	Littelfuse Inc.	Des Plaines, Illinois
ME	Methode Manufacturing Corp.	Chicago, Illinois
MU	The Muter Co.	Chicago 5, Illinois
RCA	Radio Corporation of America	Camden 2, New Jersey
SP	Sprague Electric Co.	North Adams, Massachusetts

WARRANTY

The CONRAC Division, Giannini Controls Corporation, warrants each new broadcast and industrial product manufactured by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit of its manufacture which under normal installation, use and service discloses such defect, provided the unit is delivered by the owner to us or to our authorized dealer or wholesaler from whom purchased, intact, for our examination, with all transportation charges prepaid to our factory, within one year from the date of sale to original purchaser and provided that such examination discloses in our judgment that it is thus defective.

This warranty does not extend to tubes after six months, or to any of our products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of instructions furnished by us, nor extend to units which have been altered outside of our factory, nor to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used therewith not of our own manufacture.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our radio and television products.

CONRAC DIVISION

GIANNINI CONTROLS CORPORATION

I

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